TABLE 1

-			_	$\top$	$\neg$				J		1	- 1		l l	
	Surface Roughness Ra (µm)	0.80	1 10	31.7	0:00	2.10	0.55		0.60	0.95		0.63	!	0.45	800
Conditions of Circumferential Surface and Grooves of Respective Cooling Rolls.	Ratio of Projected Area of Grooves with respect to Projected Area of Circumferential Surface	50		04	92	30	03	00	75	BO		28		63	
and Groove	Angle 8	°	0	ືຕ	ູນ	10°	2 3	15	20°	0	07	0₁=15°		$\theta_1 = 10^{\circ}$ $\theta_2 = 20^{\circ}$	7.
al Surface a	Average Pitch L <sub>3</sub> (µm)		30.0	12.5	10.0	0 00	30.0	20.0	20.0	20.0	8.0	15.0		30.0	
ircumferenti	Average Depth L <sub>2</sub>		3.2	5.0	<u>در</u>	2	8.0	2.0	0 7	0	4.0	2.5		1,5	
ditions of C	Average Width L <sub>1</sub>		15.0	5.0	0.0	3.6	27.0	30.0		0.61	6.4	9.5		20.0	
Č			Cooling Roll A	Cooling Roll B	Carlo Carlo	Cooling Hall C	Cooling Roll D	Popling Boll F	יוניון אַ ווניון	Cooling Roll F	Cooling Roll G	Cooling Roll H	•	Cooling Roll 1	

0.08

Cooling Roll J

	Properties of	Melt Spu	un Ribbons	Properties of Melt Spun Ribbons (Sample Nos. 1a to 1e)	fa to 1e)	Example 1
Sample No.	Roll Used in		Average	H <sub>c.</sub> (kA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m³)
	Manufacture of		Thickness			
	Samples		(mm)			
		-	19	647	0.95	136
This lowertion	Cooling Boll A	2	20	641	0.95	135
19		က	20	645	0.94	133
<u>.</u>		4	20	640	0.94	132
		5	19	646	0.95	135
			21	651	0.93	131
This Invention	a floa prilos	2	20	643	0.94	133
15		က	21	640	0.94	131
2	·	4	20	649	0.94	135
		5	20	645	0.93	129
			23	653	0.92	125
This Invention		2	22	655	0.93	128
100000	D IOL BUILDO	က	23	651	0.93	127
)		4	22	654	0.92	125
		ß	21	658	0.93	129
		-	25	629	0.88	115
This Invention		2	21	930	0.88	113
17	ם ווסר ציוויסס	တ	22	631	0.87	112
1	1	4	20	627	0.86	114
		5	25	624	0.88	113
		-	22	099	0.94	133
This Invention	Tallog policy	2	21	657	0.94	134
4	1 101 6 11000	က	21	655	0.93	129
1		4	21	658	0.93	130
		ഹ	22	653	0.94	131

Alloy Composition: (Nd<sub>0.7</sub>Pr<sub>0.3</sub>)<sub>10.5</sub>Fe<sub>bat.</sub>B<sub>6</sub>

TABLE 3

	Properties of	Melt Sp	un Ribbons	Properties of Melt Spun Ribbons (Sample Nos. 1f to 1j)	1f to 1j)	Example 1
Sample No.	Roll Used in		Average	H <sub>GJ</sub> (kA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m <sup>3</sup> )
	Manufacture of		Thickness			
	Carriples		Chilly			
		1	18	619	0.94	125
This founding	Tied seiler	2	19	621	0.94	129
1100 1100 1100 1		3	18	625	0.95	131
:		4	19	623	0.95	130
		ស	19	618	0.94	124
		1	21	645	0.92	119
This lawation	C lead on the	2	21	643	0.92	117
100000000000000000000000000000000000000	מ ווסר צוווווסס	ဗ	21	647	0.93	125
ņ		4	22	649	0.93	126
		2	23	644	0.93	123
		٦	20	641	0.94	129
This formation		2	22	648	0.92	123
11000000		က	20	643	0.94	130
		4	21	647	0.93	127
		5	22	645	0.92	122
		-	20	652	0.91	119
This invocation	- Hod pailoo	2	22	653	0.92	120
11.00.00.00.00.00.00.00.00.00.00.00.00.0	Tion Billions	3	22	657	0.92	121
		4	23	650	0.91	118
		5	21	649	0.91	116
		1	18	305	0.80	72
Comp		5	31	393	0.68	58
	י ויטרו אווייטטט	3	19	320	0.78	69
•		4	21	335	0.75	64
		S	29	380	0.70	09

380 0.70 60 Alloy Composition: (Nd<sub>0.7</sub>Pr<sub>0.3</sub>)<sub>10.5</sub>Fe<sub>bal</sub>.B<sub>6</sub>

TABLE 4

Average Crystal Grain Size of Hard Magnetic Phase and Magnetic Properties of Bonded Magnets Example 1

												e B
. Significant	(BH) <sub>max</sub> (Ku/III)	96	94	92	85	94	93	90	92	87	45	Alloy Composition: (Ndo.,Pro.3)10.6Febal.B6
ayı ıcıs	(;) But (;)	080	0.79	0.78	0.75	0.79	0.79	0.77	0.78	0.76	0.63	mposition: (1
or borided ividen	H <sub>GJ</sub> (kA/m)	642	643	650	625	653	616	640	629	648	335	Alloy Co
Magnetic Properties of Borney Mayi lets	Average Crystal Grain Size	27	28	33	38	32	26	31	53	33	63	
Mag	Sample No. of Melt Spun Average Crystal Ribbons Grain Size	This Invention 1a	This Invention 1b	This Invention 1c	This Invention 1d	This Invention 1e	This Invention 1f	This Invention 1g	This Invention 1h	This Invention 1i	Comp.Ex 1j.	

TABLE 5

Properties of Men Spain Laborate (MA/m) Br (T) (BH) <sub>max</sub> (kJ/m <sup>3</sup> )	<u> </u>	0.90 130	0.90 134	133		0.89	0.89	0.89	0.89 0.89 0.88 0.89	0.89 0.89 0.88 0.89	0.89 0.89 0.88 0.89 0.89	0.89 0.89 0.88 0.89 0.87 0.89	0.89 0.89 0.88 0.89 0.87 0.89 0.88	0.89 0.89 0.88 0.89 0.87 0.89 0.89	0.89 0.89 0.88 0.89 0.87 0.88 0.88 0.88	0.89 0.89 0.88 0.89 0.87 0.88 0.88 0.88 0.88	0.89 0.89 0.89 0.89 0.89 0.88 0.87 0.87 0.87	0.89 0.89 0.89 0.89 0.87 0.87 0.87 0.88 0.87 0.87	0.89 0.89 0.89 0.89 0.89 0.89 0.87 0.87 0.87 0.87 0.87	0.89 0.89 0.88 0.89 0.89 0.89 0.89 0.87 0.87 0.87 0.87 0.87 0.87 0.87	0.89 0.89 0.88 0.89 0.89 0.89 0.87 0.87 0.87 0.87 0.87 0.87 0.87	0.89 0.89 0.89 0.89 0.89 0.89 0.88 0.87 0.87 0.83 0.83 0.83 0.83 0.83 0.83 0.83 0.83 0.83	0.89 0.89 0.89 1 0.87 1 0.88 1 0.87 1 0.87 1 0.87 1 0.87 1 0.87 1 0.87 1 0.87 1 0.87 1 0.87 1 0.87 1 0.83 0.83 0.83 0.83 0.83 0.83 0.83 0.83 0.83 0.83 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.87 0.88 0.87 0.88 0.88 0.87 0.88 0.88 0.88 0.88 0.87 0.88 0.88 0.88 0.88 0.87 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.88 0.8	0.89 11 0.89 11 0.89 11 0.87 11 0.87 11 0.87 11 0.87 11 0.87 11 0.87 11 0.88 11 0.87 11 0.88 11 0.88 11 0.88 11 0.88 11 0.88 11 0.81 11 0.82 11 0.83 0.81 11 0.83 0.81 11 0.80 0.81 11 0.80 0.81 11 0.83 0.88 11	0.89 11 0.89 11 0.89 11 0.87 11 0.87 11 0.87 11 0.87 11 0.87 11 0.87 11 0.88 11 0.81 11 0.82 0.83 11 0.83 0.81 11 0.81 0.81 11 0.82 0.83 11 0.83 0.88 11 0.86 11 0.86 11 0.87 11 0.88	0.89 11 0.89 11 0.89 11 0.89 11 0.87 11 0.87 11 0.87 11 0.88 11 0.81 0.81 0.89 0.89 0.89
	(ii)	840 0	838		_																					2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
						-																				
֚֚֝֝֝֜֜֜֝֜֜֜֝֜֜֜֝֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜֜	Thickness	200	20	24	21		21	22	22 23	21 22 21 22	22 21 22 22 22 22 22 22 22	22 23 23 23 23 23 23 23 23 23 23 23 23 2	22 22 22 23 23	22 22 22 23 23 23 23 23 23 23 23 23 23 2	22 22 23 23 23 24	21 22 22 22 23 23 24 24	22 22 23 23 24 24 24 24 24	22 22 23 23 23 24 24 24 24	22 22 23 23 23 24 24 24 24 27 28 28 28 28 28 28 28 28 28 28 28 28 28	22 22 23 23 23 24 24 24 24 26 27 27 28 28 28 28 28 28 28 28 28 28 28 28 28	22 22 23 23 23 23 24 24 24 24 27 28 29 29 20 20 20 20 20 20 20 20 20 20 20 20 20	22 22 23 23 23 24 24 24 24 25 26 27 27 28 28 28 28 28 28 28 28 28 28 28 28 28	22 22 23 23 24 24 24 25 26 27 27 28 28 28 28 28 28 28 28 28 28 28 28 28	22 22 23 23 24 24 25 26 27 28 28 28 28 28 28 28 28 28 28 28 28 28	22 23 23 23 24 24 25 26 27 28 28 28 28 28 28 28 28 28 28 28 28 28	22 23 23 24 25 25 25 25 25 25 25 25 25 25 25 25 25
_	<u> </u>	-	- 0	1 6	4	5	,	-	- 0	1 2 6	1 2 6 4	- 0 6 4 c	1 2 8 4 5 -	12649-0	- 2 6 4 5 - 2 c	- 0 0 4 u - 0 0 4	T 20 7 10 T 20 7 10 T 1	- 2 6 4 2 - 2 6 4 5 -	- 2 0 4 0 - 2 0 4 0 - C	- 2 E 4 C - 2 E 4 C - 2 E	- 2 E 4 E - 2 E 4 E - 2 E	- 0 0 4 v - 0 0 4 v - 0 0 4 v	- a 6 4 a - a 6 4 a - a 6 4 a -	- 2 6 4 5 - 2 6 4 5 - 2 6 4 5 - 2		- 2 6 4 5 - 2 6 4 5 - 2 6 4 5 - 2 6 4 5 - 2 6 4 5 - 2 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6
	<del></del>					4,																				
Hollsed	Manufacture of	Sallipies		Cooling Roll A						Cooling Roll [	Cooling Roll B	Cooling Roll F	Cooling Roll E	Cooling Roll E	Cooling Roll E	Cooling Roll B	Cooling Roll E	Cooling Roll F	Cooling Roll E	Cooling Roll E	Cooling Roll B Cooling Roll C	Cooling Roll E	Cooling Roll Cooling Roll	Cooling Roll	Cooling Roll Cooling Roll	Cooling Roll B Cooling Roll D Cooling Roll E
}	Sample No. M		_	This Invention (									-		<b>!</b>	<u> </u>		<u> </u>					<u> </u>	<u> </u>	<u> </u>	antion ention dention ention

TABLE 6

Sample No. Roll Used in Manufacture of Samples  This Invention Cooling Roll G  2g  This Invention Cooling Roll H 2h  This Invention Cooling Roll H 2h  This Invention Cooling Roll I	sed in			(fa as in 1898) and in a second and a second a s	î :	
			Average	H <sub>CJ</sub> (KA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m³)
	cture of		Thickness			
	bles		(mm)			
			20	820	68'0	121
	ייייי מ	2	20	815	06'0	122
		3	19	817	06.0	126
		4	20	811	0.88	128
		5	19	814	0.89	127
		1	23	830	0.88	120
	ָרָי מייני	5	22	833	28'0	119
	5	င	24	835	28'0	121
	ii	4	22	831	0.88	117
		5	22	829	88.0	120
		-	22	833	68'0	127
		2	23	838	0.87	124
		က	21	834	68'0	121
		4	23	837	28.0	126
		5	21	835	0.88	120
		-	24	848	28.0	118
	וויסם י	2	22	850	98.0	115
I		က	21	845	0.85	113
		4	23	844	0.86	115
		5	23	846	0.85	117
		-	22	380	0.73	61
		23	30	451	0.65	54
2j		က	19	390	0.71	29
		4	33	462	0.63	50
		S	20	393	29.0	58

Alloy Composition: Nd<sub>11.5</sub>Fe<sub>bal</sub>,B<sub>4.6</sub>

TABLE 7

Average Crystal Grain Size of Hard Magnetic Phase

							—т		—			
Example 2	(BH) <sub>max</sub> (kJ/m³)	93	91	06	79	92	06	86	06	84	41	Alloy Composition: Nd11.5Febal.B4.6
Magnets	Br (T)	0.76	0.76	0.75	0.70	0.76	0.75	0.75	. 0.76	0.74	0.56	Composition
ies of Bonded	H <sub>CJ</sub> (kΑ/π)	835	841	847	819	850	810	830	835	844	402	Alloy
Average of Sonded Magnets	Average Crystal Grain Size	28	59	35	41	34	25	30	28	35	- 67	
	Sample No. of Melt Spun Average Crystal Ribbons Grain Size	This Invention 2a	This Invention 2b	This Invention 2c	This Invention 2d	This Invention 2e	This Invention 2f	This Invention 2g	This Invention 2h	This Invention 2i	Comp.Ex. 2j	

	Properties of	Melt Sp	un Ribbons	Properties of Melt Spun Ribbons (Sample Nos. 3a to 3e)	3a to 3e)	Example 3
Sample No.	Roll Used in		Average	H <sub>CJ</sub> (KA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m³)
	Manufacture of Samples		Thickness ("m")		·	
		-	21	1072	0.86	128
This lawantion	A 1100	2	22	1073	0.86	125
33	Y IIOU BIIIOOO	9	22	1071	0.85	126
5		4	22	1075	0.85	124
		5	21	1076	0.86	128
		-	22	1080	0.85	125
This Invention	Cooling Ball B	2	23	1078	0.84	122
35	מ ווסרו שיוויססס	က	22	1075	0.84	124
}		4	23	1079	0.85	125
		3	23	1074	0.84	123
		<b>-</b>	23	1090	0.83	120
This Invention		2	25	1085	0.84	117
36	)   O   O   O   O   O   O   O   O   O	က	24	1088	0.82	118
}	. <u>. 1</u>	4	25	1092	0.83	119
		5	24	1087	0.83	116
		1	27	1063	0.79	110
This Invention	C Hod soilog	7	26	1065	0.79	110
3d	A BOLL BUILDED	ဗ	23	1067	0.77	105
		4	24	1064	0.78	108
		5	22	1062	0.78	109
		-	23	1105	0.85	122
This Invention	Cooling Boll E	7	24	1110	0.84	121
3e	1 101 8 11000	9	24	1101	0.85	123
•		4	23	1099	0.84	120
		5	23	1095	0.84	121

Alloy Composition: Nd14.2(Fe0.85Co0,15)bai, B6.8

Z.

## TABLE 9

	Pronerties o	f Melt Sp	un Ribbons	Properties of Melt Spun Ribbons (Sample Nos. 3f to 3j)	. 3f to 3j)	Example 3
Sample No.	Roll Used in		Average	H <sub>cu</sub> (kA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m <sup>3</sup> )
	Manufacture of		Thickness (um)			
	Samples	-	21	1052	0.85	119
	_ ! _	- 6	20	1049	0.85	120
This Invention	Cooling Roll F	1 6.	21	1056	0.86	121
34		4	20	1050	0.86	122
		. R	21	1057	0.85	121
		, -	25	1081	0.83	117
		- 0	23	1079	0.82	115
This Invention	Cooling Roll G	1 6	23	1080	0.82	115
30			24	1078	0.82	114
}		ď	23	1076	0.83	116
		,	24	1078	0.83	122
		- 6	22	1077	0.82	120
This Invention	Cooling Roll H	1	24	1079	0.83	122
Эh		2	22	1080	0.81	119
		r L	23	1076	0.83	123
		,	23	1094	0.82	118
		-	22	1098	0.81	15
This Invention	Cooling Roll 1	1 6	24	1093	0.81	116
je.		) 4	24	1092	0.82	117
		ď	25	1095	0.81	116
		, -	32	563	09.0	25
		-	18	505	0.65	88
Comp.Ex.	Cooling Roll J	1 0	34	572	0.59	53
			49	510	99'0	65
•		יי	66	538	0.62	28
		o	T T	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,

Alloy Composition:  $Nd_{14.2}(Fe_{0.65}Co_{0.15})_{Ed}.B_{6.8}$ 

TABLE 10

Average Crystal Grain Size of Hard Magnetic Phase

										$ \tau$	
Example 3	(BH) <sub>max</sub> (kJ/m³)	88	98	83	9/	82	84	81	83	80	43
Magnets	Br (T)	0.72	0.71	0.71	0.66	0.71	0.72	0.70	0.72	0.70	0.52
les of Bonded	H <sub>cu</sub> (kA/m)	1071	1075	1086	1062	1096	1048	1075	1077	1090	542
and Magnetic Properties of Bonded Magnets	Average Crystal Grain Size (nm)	26	29	33	40	33	27	30	30	34	70
and Ma	Sample No. of Melt Spun Average Crystal Ribbons Grain Size (nm)	This Invention 3a	This Invention 3b	This Invention 3c	This Invention 3d	This Invention 3e	This Invention 3f	This Invention 3g	This Invention 3h	This Invention 3i	Comp.Ex. 3j

Alloy Composition: Nd<sub>14.2</sub>(Fe<sub>0.85</sub>Co<sub>0.15</sub>)<sub>bal</sub> B<sub>6.8</sub>

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# TABLE 11

Comp.Ex.	(ВН) <sub>мах</sub> (кЈ/м³)	32	29	30	31	31	33	33	33	32	33	34	33	34	33	34	23	22	24	24	23	36	35	34	36	35	Alloy Composition: Pr₃(Fe₀,₀Co₀₂)ඎ.B₃ ₅
4a to 4e)	Br (T)	0.78	0.77	0.78	0.78	0.77	0.79	0.80	0.80	0.79	0.79	0.81	0.80	0.81	0.81	0.81	0.72	0.71	0.73	0.73	0.71	0.82	0.81	0.81	0.82	0.81	omposition
Properties of Melt Spun Ribbons (Sample Nos. 4a to 4e)	H <sub>GJ</sub> (kA/m)	440	00+	110	108	111	115	116	117	113	115	120	118	121	119	120	108	106	109	110	107	125	123	120	128	121	Alloy C
an Ribbons	Average Thickness	10,7	200	10	19	19	19	20	19	20	19	20	22	21	22	21	24	24	20	21	19	21	21	20	20	20	
Melt Spi		1	- 6	7 6	4	22	-	2	6	4	. L	-	2	c	4	- 6	-		6	4	.co	-	2	m	4	2	
Properties of	Manufacture of	Odilipies		A line poiloge	C IIOL BIIIOOO				Cooling Boll B		-			Cooling Boll G	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8				Cooling Roll D	A WALL BURNOON				Cooling Boll F		· · · · · · · · · · · · · · · · · · ·	
	Sample No.			i L	Comp. ffx. 4a				Comp Ev 4h	COLLIPSE AND ADDRESS AND ADDRE				יין יין	2F :V1:d				Comp Ex Ad	2 X 3 X 3 X 3 X 3 X 3 X 3 X 3 X 3 X 3 X				- C	Comp.Ex. 16		

TABLE 12

	Properties o	f Melt S	pun Ribbon	Properties of Melt Spun Ribbons (Sample Nos. 4f to 4j)	. 4f to 4j)	Comp.Ex
Sample No.	Roll Used in		Average	H <sub>CJ</sub> (kA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m <sup>3</sup> )
	Manufacture of		Thickness			
	Samples		(mm)			
			18	101	02.0	18
		2	17	103	0.70	19
Comp.Ex. 41	Cooling Roll F	က	18	102	0.70	19
-		4	17	104	0.71	21
		ß	18	100	0.70	18
		-	22	114	0.79	32
		2	20	118	0.80	33
Comp.Ex. 4g	Cooling Roll G	ဗ	20	115	08.0	33
		4	20	113	62'0	32
		5	21	114	0.79	32
		-	21	113	0.79	32
		2	19	112	0.79	31
Comp.Ex. 4h	Cooling Roll H	က	21	110	0.79	30
		4	19	109	0.78	29
		c)	20	112	0.79	32
		-	20	123	0.81	34
	1	ď	19	120	0.81	32
Comp.Ex. 4i	Cooling Roll 1	3	21	119	0.81	32
	1	4	27	125	0.82	35
		2	22	121	0.81	33
	1		28	75	0.61	12
		7	18	82	0.62	13
Comp.Ex. 4j	Cooling Roll J	3	30	70	09.0	12
		4	18	83	0.62	13
		2	20	79	0.62	13
				Alloy Cor	nposition: Pr	Alloy Composition: Pr <sub>3</sub> (Fe <sub>0.8</sub> Co <sub>0.2</sub> ) <sub>bal.</sub> B <sub>3.5</sub>

William Color of the Color

TABLE 13

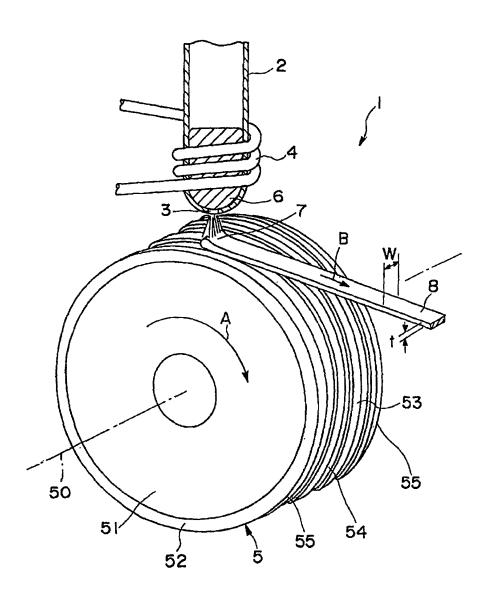
Average Crystal Grain Size of Hard Magnetic Phase

Comp.Ex.	(BH) <sub>max</sub> (kJ/m³)	21	22	23	16	25	15	22	21	24	တ
Magnets	Br (T)	99.0	0.67	0.68	0.62	0.68	0.61	0.67	0.67	0.68	0.56
ies of Bonded	H <sub>C</sub> , (kA/m)	110	113	118	107	121	100	113	109	120	69
and Magnetic Properties of Bonded Magnets	Average Crystal Grain Size (nm)	35	37	43	50	96	35	39	42	45	81
I pue	Sample No. of Melt Spun Ribbons	Comp.Ex. 4a	Comp.Ex. 4b	Comp.Ex. 4c	Comp.Ex. 4d	Comp.Ex. 4e	Comp.Ex. 41	Comp.Ex. 4g	Comp.Ex. 4h	Comp.Ex. 4i	Comp.Ex. 4j

Alloy Composition: Pr<sub>3</sub>(Fe<sub>0.8</sub>Co<sub>0.2</sub>)<sub>bel</sub>.B<sub>3.6</sub>

Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203

Fig. 1



Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203

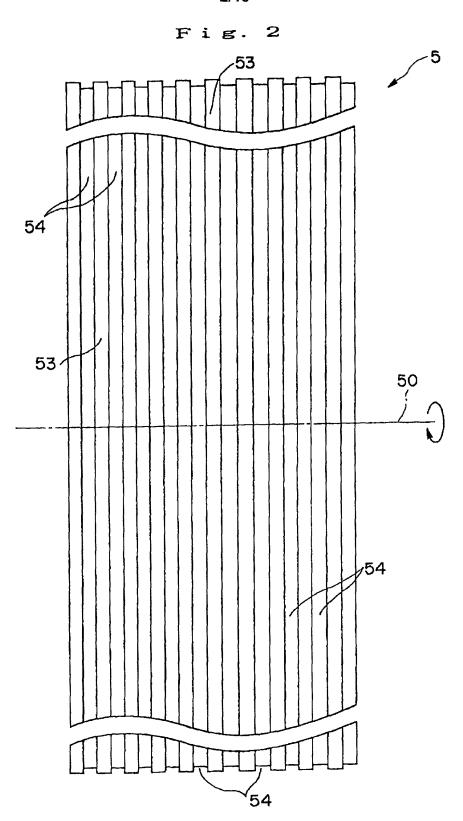
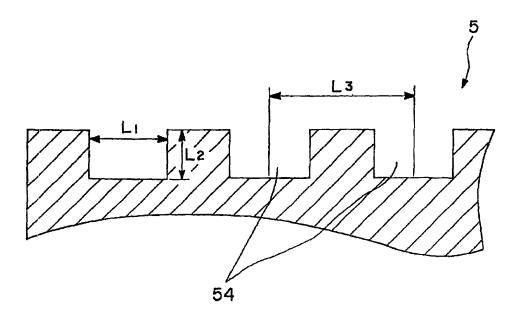


Fig. 3



Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203

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Fig. 4

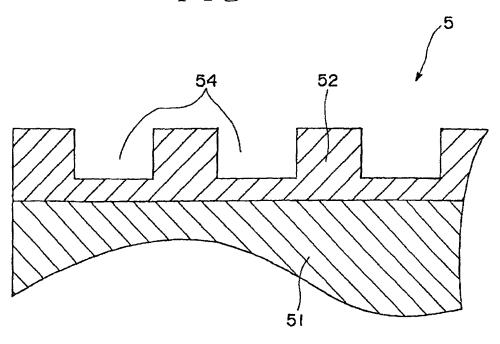
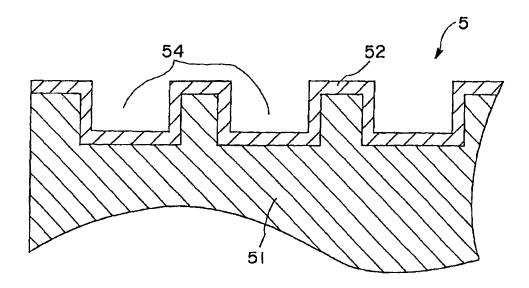
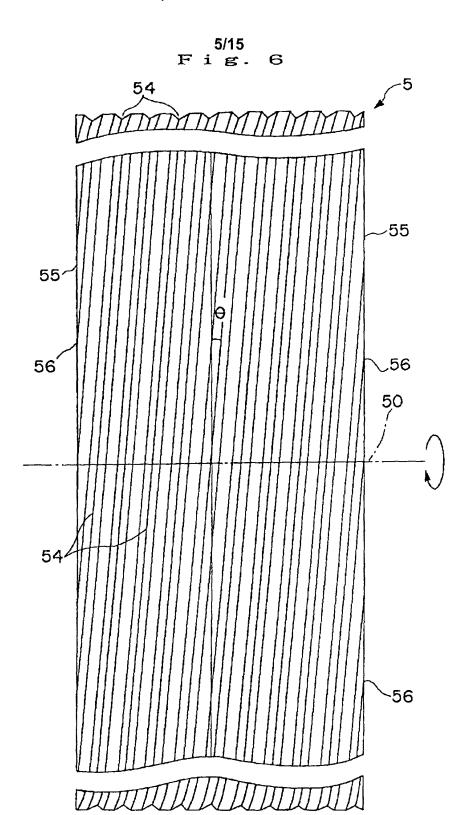


Fig. 5

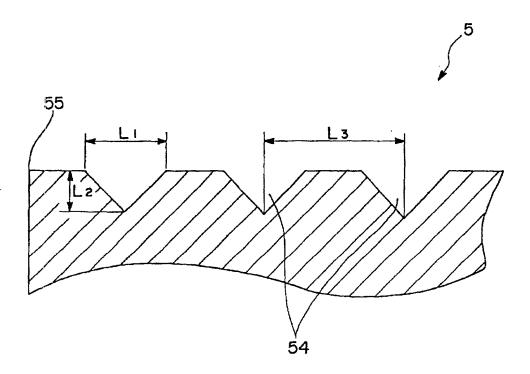


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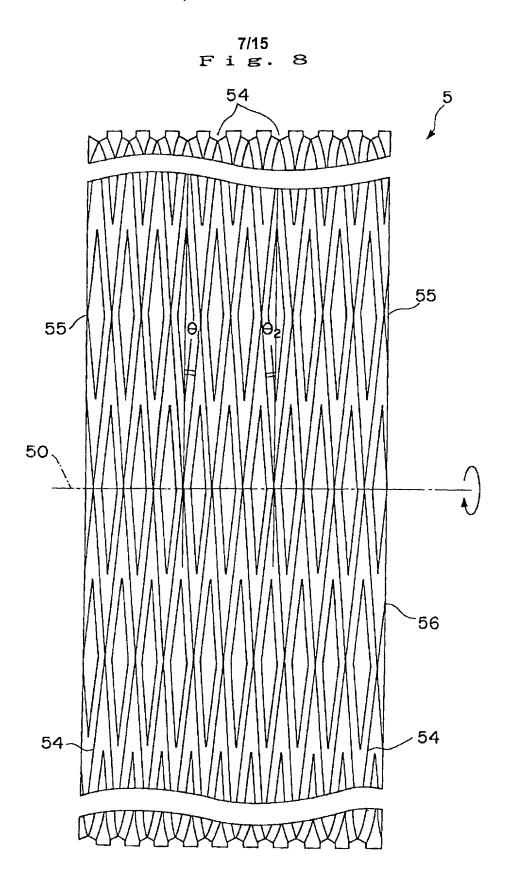


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Fig. 7



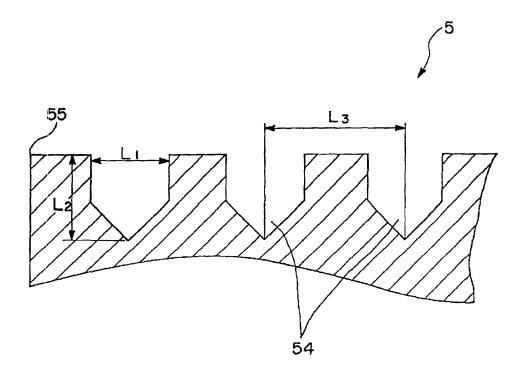
Title: METHOD OF MANUFACTURING MAGNETIC MATERIALS, AND RIBBON-SHAPED MAGNETIC MATERIALS, POWDERED MAGNETIC MATERIALS AND BONDED MAGNETS Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203



Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203

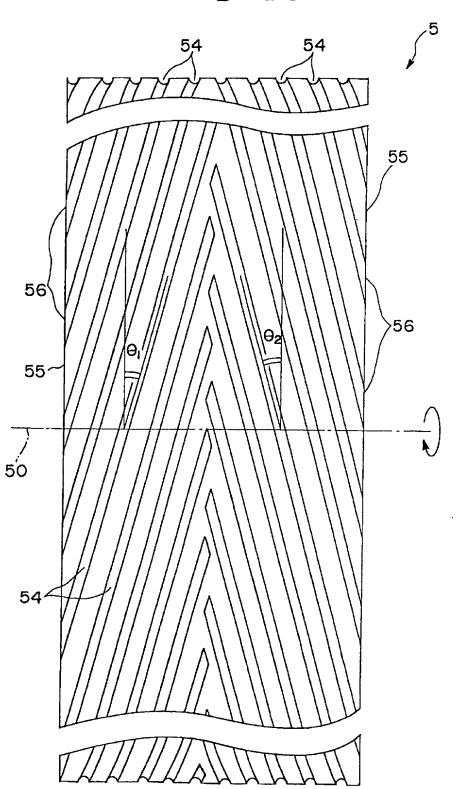
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Fig. 9



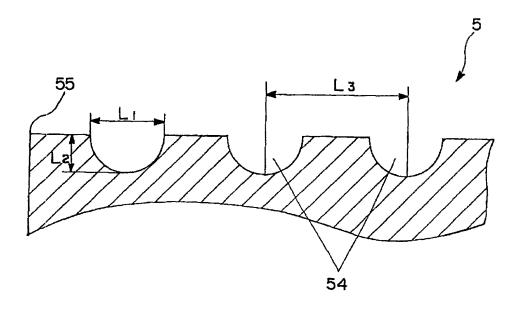
Title: METHOD OF MANUFACTURING MAGNETIC MATERIALS, AND RIBBON-SHAPED MAGNETIC MATERIALS, POWDERED MAGNETIC MATERIALS AND BONDED MAGNETS Inventors: Akira ARAI and Hiroshi KATO
Atty. Ref. No.: 9319A-000203

9/15 Fig. 10



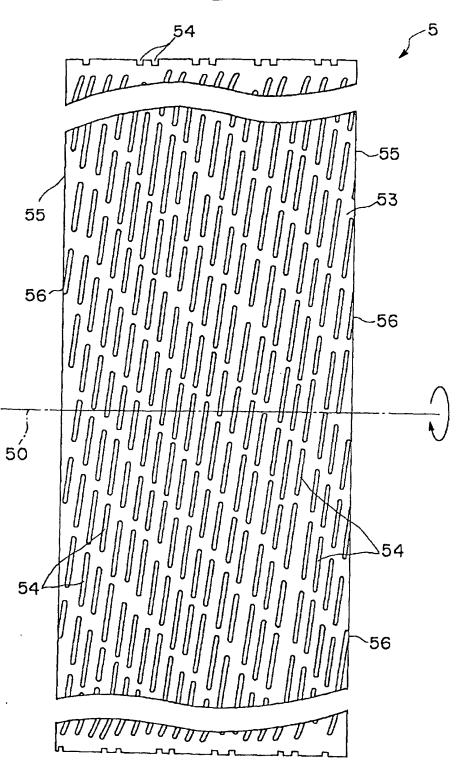
Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203

Fig. 11

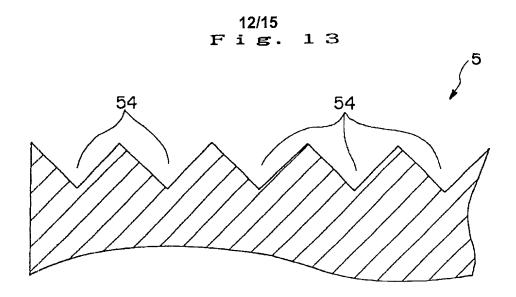


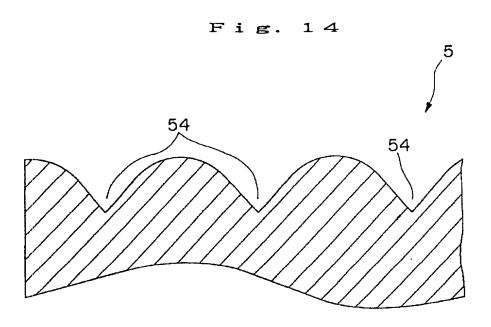
Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203

11/15 Fig. 12



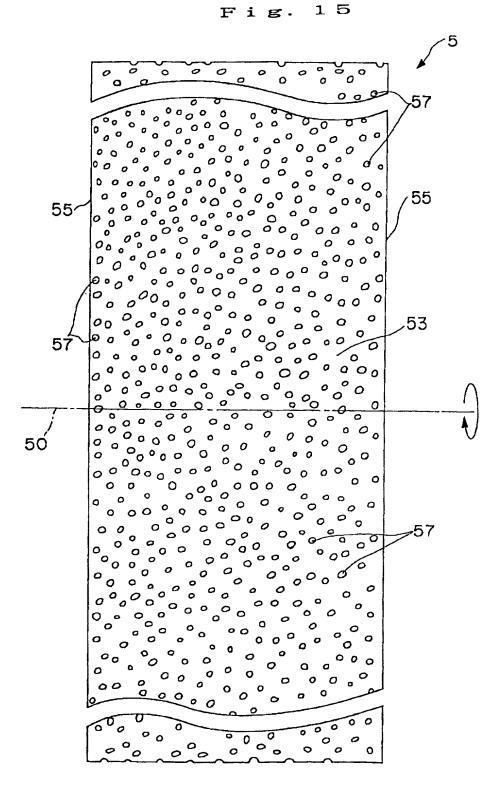
Title: METHOD OF MANUFACTURING MAGNETIC MATERIALS, AND RIBBON-SHAPED MAGNETIC MATERIALS, POWDERED MAGNETIC MATERIALS AND BONDED MAGNETS Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203





Title: METHOD OF MANUFACTURING MAGNETIC MATERIALS, AND RIBBON-SHAPED MAGNETIC MATERIALS, POWDERED MAGNETIC MATERIALS AND BONDED MAGNETS Inventors: Akira ARAI and Hiroshi KATO Atty. Ref. No.: 9319A-000203

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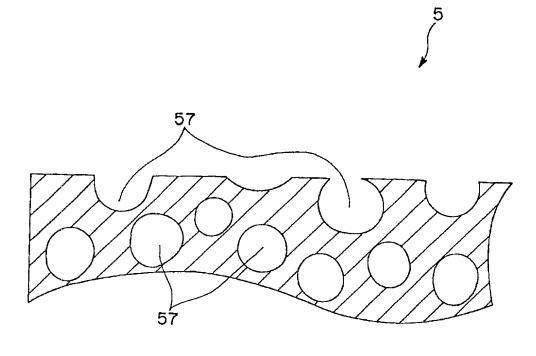


Title: METHOD OF MANUFACTURING MAGNETIC MATERIALS, AND RIBBON-SHAPED MAGNETIC MATERIALS, POWDERED MAGNETIC MATERIALS AND BONDED MAGNETS Inventors: Akira ARAI and Hiroshi KATO

Atty. Ref. No.: 9319A-000203

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Fig. 16



Title: METHOD OF MANUFACTURING MAGNETIC MATERIALS, AND RIBBON-SHAPED MAGNETIC MATERIALS, POWDERED MAGNETIC MATERIALS AND BONDED MAGNETS Inventors: Akira ARAI and Hiroshi KATO

Atty. Ref. No.: 9319A-000203

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Fig. 17

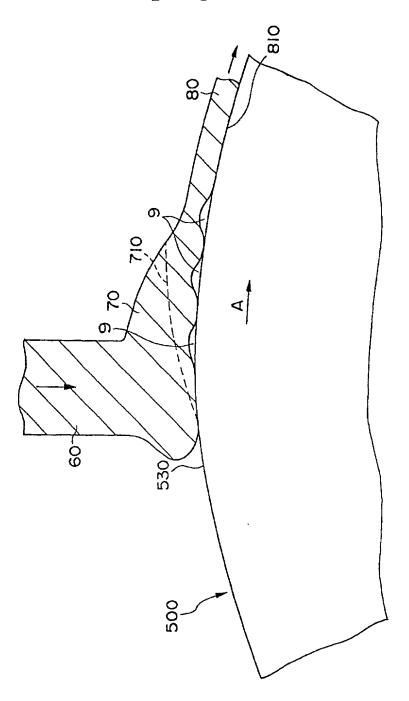


TABLE 1

	Surface	Houghness na (µm)		0.80	1.12	61.6	0:00	2.10	0.55	20.0	0.60	0.05	0000		0.63		0.45	0.08		
Grooves of Circumferential Surface and Grooves of Respective Cooling Rolls.	Ratio of Projected Area of	Grooves with respect to Projected	(%)	50	70	2	92	30		09	75		80		58		63			
and Groove	Angle 0	)		ာင	0	3	ດນຶ	0 4	2		000	20	28°	1	0,=15°	7	θ <sub>1</sub> =10° Θ <sub>1</sub> =20°	22	•	
ial Surface	Average	Pitch L <sub>3</sub>	(m <sub>H</sub> )	30.0	200	12.5	000	2 3	90.0	50.0	0 00	20.0	80		15.0		30.0		ı	
iroumferent	Average	Depth L2	(mrl)	C	3.6	5.0	4	5.	8.0	2.0	211	1,8	4.0	P	2.5		1,5		s	
) 40 CH 61117	Altions of C	Width L	(mrd)	1	15.0	5.0	6	3.6	27.0	30.0	200	15.0	7 3	0.4	9.5		20.0		ľ	
	S -				Cooling Roll A	Cooling Ball B		Coaling Hall C	Cooling Roll D		Cooling Hall E	Cooling Roll F		Cooling Holl G	Cooling Roll H	6.	Cooling Boll 1	6	Cooling Roll J	

TABLE 2

	TO SON IOROL I	vieit op	In Albbons	Properties of Meit Spun Hippons (Sample Nos. 1a to 1e)	la to le)	Example 1
Sample No.	Roll Used in Manufacture of		Average	H <sub>cJ</sub> (kA/m)	E E	(ВН) <sub>тах</sub> (кJ/m³)
	Samples		(mrl)			
		-	19	647	0.95	136
This law antion	A Bod seiloo?	2	20	641	0.95	135
	A lion grillood	က	20	645	0.94	133
		4	20	640	0.94	132
		ນ	19	646	0.95	135
		1	21	651	0.93	131
- Contract		2	20	643	0.94	133
11115 IIIVENIUUI 4 h	a liou fillingo	က	21	640	0.94	131
		4	20	649	0.94	135
		S	20	645	0.93	129
		1	23	653	0.92	125
This law antion		2	22	655	0.93	128
		က	23	651	0.93	127
		4	22	654	0.92	125
		വ	21	658	0.93	129
		-	25	629	0.88	115
This law continu		7	21	630	0.88	113
10111011	C IION BITINOS	3	22	631	28.0	112
		4	20	627	0.86	114
		5	25	624	0.88	113
		-	22	099	0.94	133
Cotto		2	21	657	0.94	134
100000000000000000000000000000000000000		က	21	655	0.93	129
		4	21	658	0.93	130
		5	22	653	0.94	131

Alloy Composition: (Nd<sub>0.7</sub>Pr<sub>0.3</sub>)<sub>10.5</sub>Fe<sub>bat.</sub>B<sub>6</sub>

	Properties of	Melt Spi	un Ribbons	Properties of Melt Spun Ribbons (Sample Nos. 1f to 1])	1f to 1j)	Example 1
Sample No.	Roll Used in Manufacture of		Average Thickness	H <sub>cJ</sub> (kA/m)	Br (C)	(BH) <sub>max</sub> (kJ/m³)
	Samples	-	(mm)	0.50		
		- -	8	619	0.94	125
This Invention	Cooling Boll F	2	19	621	0.94	129
1		က	18	625	0.95	131
:		4	19	623	0.95	130
		2	19	618	0.94	124
		1	21	645	0.92	119
This lowerthan	O llog pailog	2	21	643	0.92	117
10	ם ווחר פווווחסט	က	21	647	0.93	125
n		4	22	649	66.0	126
		5	23	644	0.93	123
		-	20	641	0.94	129
This Invantion		2	22	648	0.92	123
14	- I I I I I I I I I I I I I I I I I I I	က	20	643	0.94	130
:		4	21	647	0.93	127
		5	22	645	0.92	122
		-	20	652	0.91	119
This Invention		2	22	653	0.92	120
1:	T IIOU BI IIIOOO	9	22	657	0.92	121
•		4	23	650	0.91	118
		5	21	649	0.91	116
		-	18	305	0.80	72
Somo Ev	Cooling Ball 1	7	31	393	0.68	58
1		3	19	320	0.78	69
•		4	21	335	0.75	64
		5	29	380	0.70	09

Alloy Composition: (Nd<sub>0.7</sub>Pr<sub>0.3</sub>)<sub>10.5</sub>Fe<sub>bal.</sub>B<sub>6</sub>

**TABLE 4** 

Average Crystal Grain Size of Hard Magnetic Phase and

Example 1	(ВН) <sub>тах</sub> (кЈ/т³)	96	94	92	85	94	93	06	92	87	45
agnets	Br (T)	0.80	0.79	0.78	0.75	0.79	0.79	0.77	0.78	0.76	0.63
of Bonded Ma	H <sub>GJ</sub> (kA/m)	642	643	650	625	653	616	640	629	648	335
Magnetic Properties of Bonded Magnets	Average Crystal Grain Size (nm)	27	28	33	38	32	56	31	29	33	63
Mac	Sample No. of Melt Spun Average Crystal Ribbons Grain Size (nm)	This Invention 1a	This Invention 1b	This Invention 1c	This Invention 1d	This Invention 1e	This Invention 1f	This Invention 1g	This Invention 1h	This Invention 1i	Comp.Ex 1j.

Alloy Composition: (Nd<sub>0.7</sub>Pr<sub>0.3</sub>)<sub>10.5</sub>Fe<sub>bal.</sub>B<sub>6</sub>

1		-				
Sample No.	Roll Used in Manufacture of		Average Thickness	H <sub>⇔</sub> (kA/m)	(E) Bir (E)	(BH) <sub>max</sub> (KJ/m³)
	Samples		(mm)			
		-	20	840	06.0	130
	:	2	20	838	0.90	134
This Invention	Cooling Holl A	6	21	832	0.89	133
2a		4	21	835	0.89	132
		5	21	837	0.89	131
		-	22	848	0.88	127
		2	21	841	0.89	125
This Invention	Cooling Roll B	62	22	846	0.87	129
8		4	21	842	0.89	123
		5	22	849	0.88	125
		-	23	850	0.87	124
		2	22	853	0.88	121
This Invention	Cooling Roll C	က	24	846	0.87	125
ಬ		4	23	848	0.87	122
		5	24	849	0.88	123
		-	21	826	0.83	110
		2	26	818	0.81	108
This Invention	Cooling Roll D	6	25	820	0.82	109
23		4	22	827	08'0	106
		ß	23	824	0.81	107
		-	22	856	0.89	130
		2	22	853	0.88	131
This Invention	Cooling Roll E	9	23	849	0.88	126
2e		4	23	852	0.88	127
		5	22	847	0.89	128

Example 2	( חוו/א) אפש (בכן)		121	122	126	128	127	120	119	121	117	120	127	124	121	126	120	118	115	113	115	117	61	54	62	20	58
2f to 2j)	(E)		0.89	0.90	0.90	0.88	0.89	0.88	0.87	0.87	0.88	0.88	0.89	0.87	0.89	0.87	0.88	0.87	0.86	0.85	0.86	0.85	0.73	0.65	0.71	0.63	0.67
Properties of Melt Spun Ribbons (Sample Nos. 2f to 2j)	H <sub>™</sub> (kA/m)		820	815	817	811	814	830	833	835	831	829	833	838	834	837	835	848	850	845	844	846	380	451	390	462	393
un Ribbons	Average	(mm)	000	200	10	2 00	19	23	22	24	22	22	22	23	2	23	7	24	20	23	23	23	22	30	19	33	20
Melt Sp			+	- 6	3 6	S 4	r u	, -	. 6	1 6.	0 4	ינ	,  -	- 0	1 4	0 4	·	7	- 6	1 6	4	- LC	, -	. 0		0 4	. 2
Properties of	Roll Used in	Manufacture of	Sallipies	_	Cooling Roll F	<b>_</b>	_1_		1.	Cooling Roll G					Cooling Roll H	•				Cooling Roll 1					Cooling Roll J		
	Sample No.				This Invention	77				This Invention	29	<u> </u>			This Invention	岩				This Invention	Z				Comp.Ex.	-2	

TABLE 7

Average Crystal Grain Size of Hard Magnetic Phase and Mannetic Properties of Bonded Magnets

											<del></del> -
Example 2	(BH) <sub>max</sub> (kJ/m³)	93	91	06	79	65	06	86	06	84	41
Magnets	Br (T)	0.76	0.76	0.75	0.70	0.76	0.75	0.75	0.76	0.74	0.56
ies of Bonded	H <sub>CJ</sub> (kA/m)	835	841	847	819	850	810	830	835	844	402
and Magnetic Properties of Bonded Magnets	Average Crystal Grain Size (nm)	28	29	35	14	34	25	30	28	35	29
and M	Sample No. of Melt Spun Average Crystal Ribbons Grain Size (nm)	This Invention 2a	This Invention 2b	This Invention 2c	This Invention 2d	This Invention 2e	This Invention 2f	This Invention 2g	This Invention 2h	This Invention 2i	Comp.Ex. 2j

Alloy Composition: Nd<sub>11.5</sub>Fe<sub>bal.</sub>B<sub>4.6</sub>

Boll lead in		off lead in Average H (I/A/m) Br (T)	(m) (//)	D. (T)	(ma) // (ma)
Manufacture of		Average	T <sub>Cl</sub> (KA/m)	(i) ai (ii)	(BH) <sub>max</sub> (KJ/M²)
samples		(m <sup>rl</sup> )			
	-	21	1072	98.0	128
۸ اامق عمنامی	2	22	1073	0.86	125
Y lion fillions	ဗ	22	1071	0.85	126
	4	22	1075	0.85	124
	5	21	1076	98.0	128
	-	22	1080	0.85	125
	2	23	1078	0.84	122
a lion grilloo	ဗ	22	1075	0.84	124
	4	23	1079	0.85	125
	2	23	1074	0.84	123
	-	23	1090	0.83	120
	2	25	1085	0.84	117
	ဗ	24	1088	0.82	118
	4	25	1092	0.83	119
	5	24	1087	0.83	116
	1	27	1063	0.79	110
	2	26	1065	0.79	110
ם ווסט לוווווסס	ဗ	23	1067	0.77	105
	4	24	1064	0.78	108
	5	22	1062	0.78	109
	-	23	1105	0.85	122
المقامون	2	24	1110	0.84	121
	3	24	1101	0.85	123
	4	23	1099	0.84	120
	ľ	23	3001	700	101

Alloy Composition: Nd<sub>14,2</sub>(Fe<sub>0.85</sub>Co<sub>0.15</sub>)<sub>bal.</sub>B<sub>6.8</sub>

Z.

### TABLE 9

	Properties (	of Melt Sp	oun Ribbons	Properties of Melt Spun Ribbons (Sample Nos. 3f to 3i)	. 3f to 3j)	Example 3
Sample No.	Roll Used in		Average	H <sub>CJ</sub> (kA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m <sup>3</sup> )
	Manutacture of Samples		Thickness (um)			
			21	1052	0.85	119
This Invention	Conting Boll E	2	20	1049	0.85	120
34		က	21	1056	0.86	121
5		4	20	1050	0.86	122
		5	21	1057	0.85	121
		-	25	1081	0.83	117
This Invention	College pollog	2	23	1079	0.82	115
30		က	23	1080	0.82	115
n )		4	24	1078	0.82	114
		5	23	1076	0.83	116
		-	24	1078	0.83	122
This Invention		2	22	1077	0.82	120
ah Se	Builde	ဗ	24	1079	0.83	122
		4	22	1080	0.81	119
		ιΩ	23	1076	0.83	123
		-	23	1094	0.82	118
This Invention	Cooling Ball 1	2	22	1098	0.81	115
3.	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	ဇ	24	1093	0.81	116
3		4	24	1092	0.82	117
		3	25	1095	0,81	116
		-	32	563	09.0	52
Comp Ex	Cooling Boll 1	2	18	505	0.65	88
3.		က	34	572	0.59	53
`		4	19	510	99'0	99
		2	22	538	0.62	58

Alloy Composition: Nd<sub>14.2</sub>(Fe<sub>0.65</sub>Co<sub>0.15</sub>)<sub>FeJ</sub>,B<sub>6.8</sub>

TABLE 10

Average Crystal Grain Size of Hard Magnetic Phase

Example 3	(BH) <sub>max</sub> (kJ/m³)	88	86	83	76	85	84	81	83	80	43
Magnets	Br (T)	0.72	0.71	0.71	0.66	0.71	0.72	0.70	0.72	0.70	0.52
les of Bonded I	H <sub>cu</sub> (kA/m)	1071	1075	1086	1062	1096	1048	1075	1077	1090	542
and Magnetic Properties of Bonded Magnets	Average Crystal Grain Size (nm)	26	29	33	40	33	27	30	30	34	20
and Mk	Sample No. of Melt Spun Average Crystal Ribbons Grain Size (nrn)	This Invention 3a	This Invention 3b	This Invention 3c	This Invention 3d	This Invention 3e	This Invention 3f	This Invention 3g	This Invention 3h	This Invention 3i	Comp.Ex. 3j

Alloy Composition: Nd<sub>14.2</sub>(Fe<sub>0.85</sub>Co<sub>0.15</sub>)<sub>bel</sub> B<sub>6.8</sub>

	Properties of	Melt Sp	un Ribbons	Properties of Melt Spun Ribbons (Sample Nos. 4a to 4e)	4a to 4e)	Comp.Ex.
Sample No.	Roll Used in		Average	H <sub>c.</sub> ı (kA/m)	Br (T)	(BH) <sub>max</sub> (kJ/m³)
	Manufacture of Samples		(km)			
		-	18	113	87.0	32
		2	18	109	0.77	29
Comp.Ex. 4a	Cooling Roll A	ဗ	19	110	0.78	30
•		4	19	108	0.78	31
	<b>L</b>	5	19	111	0.77	31
		-	19	115	0.79	33
		2	20	116	0.80	33
Comp.Ex. 4b	Cooling Roll B	က	19	117	0.80	33
•	•	4	20	113	0.79	32
		3	19	115	0.79	33
		-	20	120	0.81	34
		2	22	118	08'0	33
Comp.Ex. 4c	Cooling Roll C	က	21	121	0.81	34
•	•	4	22	119	0.81	33
		5	21	120	0.81	34
		-	24	108	0.72	23
		2	24	106	0.71	22
Comp.Ex. 4d	Cooling Roll D	က	20	601	0.73	24
-	,	4	21	110	0.73	24
	-	S	19	107	0.71	23
		1	21	125	0.82	36
	-	2	21	123	0.81	35
Comp.Ex. 4e	Cooling Roll E	တ	20	120	0.81	34
		4	20	128	0.82	36
		2	20	121	0.81	35

Alloy Composition: Pr<sub>3</sub>(Fe<sub>0.8</sub>Co<sub>0.2</sub>)<sub>rol.</sub>B<sub>3.5</sub>

TABLE 12

	Properties	of Meit S	pun Ribbon	Properties of Melt Spun Ribbons (Sample Nos. 4f to 4j)	. 4f to 4j)	Comp.Ex
Sample No.	Roll Used in Manufacture of		Average	H <sub>CJ</sub> (kA/m)	E m	(BH) <sub>max</sub> (kJ/m³)
	Samples		(mrl)			
		-	18	101	0.70	18
		2	17	103	0.70	19
Comp.Ex. 4t	Cooling Roll F	က	18	102	0.70	19
		4	17	104	0.71	21
		2	18	100	0.70	18
		,	22	114	0.79	32
		2	20	118	08.0	33
Comp.Ex. 4g	Cooling Roll G	3	20	115	08.0	33
		4	20	113	62'0	32
		3	21	114	0.79	32
			21	113	0.79	32
		2	19	112	0.79	31
Comp.Ex. 4h	Cooling Roll H	က	21	110	0.79	30
		4	19	109	0.78	29
		ည	20	112	62.0	32
		-	20	123	0.81	34
		2	19	120	0.81	32
Comp.Ex. 4i	Cooling Roll 1	3	21	119	0.81	32
		4	24	125	0.82	35
		5	22	121	0.81	33
		1	28	75	0.61	12
		2	18	82	0.62	13
Comp.Ex. 4j	Cooling Roll J	က	30	70	0.60	12
		4	18	83	0.62	13
		ம	20	79	0.62	13

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TABLE 13

Average Crystal Grain Size of Hard Magnetic Phase

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Comp.Ex.	(BH) <sub>max</sub> (kJ/m³)	21	22	23	16	25	15	22	21	24	o
<b>Magnets</b>	Br (T)	99.0	0.67	0.68	0.62	0.68	0.61	0.67	0.67	0.68	0.56
ties of Bonded	H <sub>CJ</sub> (kA/m)	110	113	118	107	121	100	113	109	120	69
and Magnetic Properties of Bonded Magnets	Average Crystal Grain Size (nm)	35	37	43	20	39	35	39	42	45	81
	Sample No. of Melt Spun Ribbons	Comp.Ex. 4a	Comp.Ex. 4b	Comp.Ex. 4c	Comp.Ex. 4d	Сотр.Ех. 4е	Comp.Ex. 4f	Comp.Ex. 4g	Comp.Ex. 4h	Comp.Ex. 4i	Comp.Ex. 4j

Alloy Composition: Pr<sub>3</sub>(Fe<sub>0.8</sub>Co<sub>0.2</sub>)<sub>bel</sub> B<sub>3.5</sub>